INTRODUCTION:

Plants need the right combination of nutrients to live, grow and reproduce. When plants suffer from malnutrition, they show symptoms of being unhealthy. Too little or too much of any one nutrient can cause problems. The productivity of agriculturally important plants is often limited by the availability of essential mineral nutrients in the soil. In addition to water, plants require thirteen essential mineral nutrients to complete their full lifecycle. That is, although in the absence of an essential nutrient it may be possible for the plant to grow, it will definitely not be possible for it to reproduce successfully. Plant nutrients and organic material are essential elements for healthy plant growth and thereby food supplies. Depletion of plant nutrients (macro nutrients and micro nutrients) or organic material may lead to severe agricultural as well as environmental problems, such as insufficient crop yield, economic recession, famine, soil erosion and desertification (Campbell, 1998; Gardner, 1997). Essential mineral nutrients can be divided into macro- and micro-nutrients depending on the amount required by plants. The macro-nutrients are: nitrogen, potassium, sulphur, phosphorus, magnesium and calcium, and micro-nutrients are: iron, zinc, manganese, copper, molybdenum, boron, and chlorine.

A micronutrient deficiency (or trace mineral deficiency) is a physiological plant disorder which occurs when a micronutrient is deficient in the soil in which a plant grows. India was dependent on external food supplies in the early 1960s. To meet the growing demand for food, fiber and fuel, high yielding cultivars were introduced. These high yielding crop cultivars were highly responsive to fertilizers. Thus, slowly the soils were exhausted of their nutrients. Application of major nutrients (nitrogen, phosphorus, and potassium) became common; therefore the crops started responding to micronutrient fertilizers (Gupta A, P.,2005).

Over the last few decades efforts have been made to increase crop production by changing the soil to the plants. This approach, including the heavy use of chemical fertilizers, was successful in improving soil properties and increasing crop productivity. However, it also caused problems such as high input of energy, labour and money, as well as environmental pollution and resource depletion. Application of this metal to soil is converted to the other complex forms which are not readily utilized by the plant. In short these metals make complex form with other metal. Before that, these all metals are available as different form in soil.

Siderophore: Under condition of Fe limitation, microorganisms and plants commonly rely on chelating agents to solubilize and transport inorganic Fe. Siderophores (from the Greek: iron carriers) which are defined as relatively low molecular weight, ferric ion specific chelating agents synthesized by bacteria, actinomycetes, fungi and certain algae growing under low ironic stress. Chemically siderophores are iron binding proteins with molecular weight ranging from 400 - 1500 Da. The role of these compounds is to scavenge iron from the environment and to make the mineral, which is almost always essential, available to the microbial cell. Though they are specific ferric iron chelator, but is reported that microbial siderophore can chelate the various metals like Cu, Zn, Mn, Co, Mo, Ni, V, Al, Pb, Cd. The micronutrients that are known to be required by plants are iron, zinc, copper, manganese, cobalt, nickel, boron, molybdenum and chlorine. These methodologies are applied to various types of plants (crops, vegetable, flower etc.)which are unable to grow or poorly grow in soil.If this siderophore bind to transient metal then it must bind various other metals like heavy metals, which are largely produced by industres and it damage the soil properties. To come out from this problem various chemical method are available but are not efficient. So application of such organism whose siderophore chelate heavy metals will solve the problem.

AIM AND OBJECTIVES

1. To isolate siderophore producing microorganism from various source and extraction of siderophore from isolated microorganism.
2. Using spectrophotometer assay to determine the chelation of metals with extracted siderophore and find out the chelation of metals with siderophores.
3. Perform biological assay to determine uptake of different metal chelated siderophores by microorganism.
4. Pot study on agricultural crops(Rice : ***Oryza sativa*** and Tuver: ***Cajanus cajan***) and vegetable (Tomato : ***Solanum lycopersicum***)

MATERIALS AND METHODS:

1. **Isolation of Siderophore Producing Microorganisms**

   Soil samples from surface , sub surface (3-inch depth) and water samples (one foot deep) were taken and were serially diluted and plated on Nutrient agar plates. The plates were incubated at 37± 2ºC and were observed after 24h.

2. **Detection of Siderophore**

   Isolates were checked for their siderophore production by Chrome azurol-S (CAS) liquid assay and plate assay.

3. **Estimation of Siderophore**

   The presence of catechol-phenolic-type siderophores was tested according to Arnow and the presence of hydroxamate siderophores in the supernatant was checked according to Gibson and Magrath.

4. **Screening of Metals For Complexation With Siderophore**

   Though siderophore are specific ferric iron chelator, but microbial siderophore can chelate the various metals like Cu, Zn, Mn, Co, Mo, Ni, V, Al, Pb, Cd also was determine by '**CAS agar diffusion (CASD) assay'** and spectrophotometer assay.

5. **Pot study on Crop plant**

   Application of most efficient siderophore producer isolates on Crop plant (Rice : *Oryza sativa* and Tuver: *Cajanus cajan*) and vegetable (Tomato : *Solanum lycopersicum*)

RESULTS:

Microbes are ubiquitous and significant regulators of many of earth's fundamental processes. Bacteria are found nearly everywhere on Earth, growing in soil, acidic hot springs, radioactive waste, seawater, and deep in the Earth's crust. In addition to their notorious role of causing disease, bacteria are vital in the recycling of nutrients. Under condition of Fe limitation, microorganisms produce siderophore to solubilize and transport inorganic Fe. The most active strains in the production of siderophores were classified to genus *Pseudomonas.* Most active siderophore-producing strains were isolated from the rhizospheres of *Cajanus Cajan. Isolates* showed a high ability to produce both hydroxamate type and catecholate type siderophores.

Siderophores are produced by various soil microbes to bind Fe3+ from the environment, transport it back to the microbial cells and make it available for growth. However, microbial siderophores also be utilized by plants as an iron source. Though they are specific ferric iron chelator, but microbial siderophore canalso chelate the various metals like Cu, Zn, Mn, Co, Mo, Ni, V, Al, Pb, Cd .Application of most active siderophore produce isolates showed significant promotion of plant-growth based on seed germination and root elongation in Rice ,Tuver and Tomato plants, in comparison with control.

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